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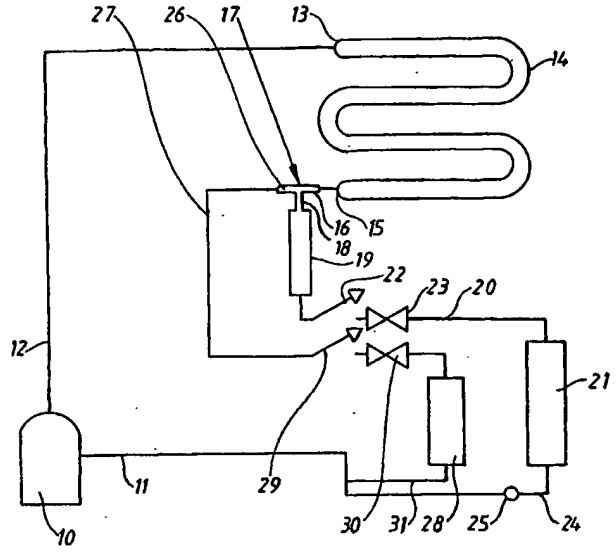
(54) Title: REFRIGERATION SYSTEM AND A METHOD FOR OPERATING SUCH SYSTEM



(57) Abstract: This invention relates to a refrigeration system comprising one compressor (10) that via a closed circuit containing a circulating refrigerant is connected to a condenser (14, 14a) and two or more evaporators (21, 28). The circuit comprises a container (19, 19a) or the like communicating with the condenser (14, 14a) and has at least a first outlet communicating with at least one evaporator (21) via a first valve (22, 22a). The container (19, 19a) is arranged to receive and temporarily store a container (19, 19a) is arranged to receive and temporarily store a certain volume of the refrigerant flowing from the condenser. The container (19, 19a) is also provided with at least a second outlet (26, 26a) communicating with one or several of the additional evaporators (28) to circulate the remaining part of the refrigerant through the at least one of the last mentioned evaporators (28) when said volume has been stored in the container (19, 19a), said second outlet (26, 26a) being positioned above said first outlet.

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Refrigeration system and a method for operating such system

TECHNICAL FIELD

This invention relates to a refrigeration system comprising one compressor that via a closed circuit containing a circulating refrigerant is connected to a condenser and two or more evaporators. The invention also relates to a method for operating such a system.

BACKGROUND

Refrigerator systems of the type mentioned above are previously known and are used for instance in refrigerators/freezers. When using two or more evaporators, in these kinds of systems, there will be problems to achieve maximum energy efficiency for the system if each evaporator is working under different temperature level and/or heat load. If the evaporators are serial or parallel connected, without other devices, the lowest temperature (together with highest) in the system will determine the system coefficient of performance (COP)and therefore the energy consumption.

One way to solve this problem is to separate parallel-connected evaporators with valves and run them under different conditions. The problem with this solution is that different conditions require different amounts of refrigerant. A way of solving these problems is by means of a device having the characteristics mentioned in the claims.

DESCRIPTION OF FIGURES

An embodiment of the invention will now be described with reference to the accompanying drawing on which Fig 1. is a schematic view of a first embodiment of the invention whereas Fig. 2 is a schematic view of a second embodiment.

DESCRIPTION OF AN ILLUSTRATIVE EMBODIMENT

According to Fig. 1 there is a compressor 10 that is connected to a suction pipe 11 and a pressure pipe 12 of a closed circuit containing a refrigerant. The pressure pipe 12 that contains the refrigerant in a gaseous state under high pressure is connected to an inlet side 13 of a condenser 14 in which the gas gradually condenses to its liquid state. The outlet side 15 of the condenser is connected to an inlet branch 16 of a T-piece 17 having a vertical branch 18 ending in a container 19 in which a certain volume of the condensate can be temporarily hidden. At the bottom of the container there is a pipe 20

that is connected to an inlet side of a first, high load evaporator 21 via a valve 22 and a first expansion device 23. An outlet pipe 24 of the first evaporator 21 is via a check valve 25 connected to the suction pipe 11 in which the refrigerant exists in vapor state at low pressure.

An outlet branch 26 of the T-piece 17 is via a pipe 27 connected to a second, small load evaporator 28 by means of a second valve 29 and a second expansion device 30. An outlet pipe 31 of the second evaporator 28 is also connected to the suction pipe 11.

The first evaporator 21 is a high load evaporator with a low pressure whereas the second evaporator 28 is a small load evaporator under high pressure.

The system operates in the following manner. From the suction pipe 11 at the low-pressure side of the compressor 10 the vapor is compressed to a high pressure and distributed to the pressure pipe 12 by means of the compressor 10. The gas enters into the condenser 14 from the inlet side 13 and is cooled such that it gradually condenses to a warm condensate. The warm condensate flows from the outlet side 15 of the condenser into the inlet branch 16 of the T-piece 17 and further through the vertical branch 18 from which it by gravity flows into the container 19. Provided that the valve 22 is open the refrigerant enters the first, high load evaporator 21 via the expansion device 23 under a considerably lower pressure. The low pressure condensate now takes up heat from the cooling space in which the evaporator is placed and simultaneously it boils. The vapor that is created has a low pressure and flows through the check valve 25 into the suction pipe 11.

If on the other hand the valve 22 is closed the warm condensate will be collected and temporarily hidden and trapped in the container 19 until the container is filled. Then the remaining amount of refrigerant in the system will, provided that the valve 29 is open, instead flow through the outlet branch 26 of the T-piece, the pipe 27, the expansion device 30 and the second, small load evaporator 28 to the suction pipe 11 thereby cooling the space in which the second evaporator is placed.

It should be understood by the person skilled in the art that the scope of the invention is the level relation in positioning between the first outlet of the container (19) connecting

it with the first valve (22,22a) and the second outlet of the container connecting it with the second valve (29,29a). The relation in level will define the volume of warm condensate that will be collected and temporarily hidden and trapped in the container when the first valve is closed. This means that as long as the second outlet is positioned above the first outlet (or the other way around) a volume will be defined in which the condensate is collected. The word "above" means that the outlets do not need to be positioned straight above each other. They can instead be displaced in relation to each other.

The valves 22 and 29, the compressor 10 and conventional temperature sensors are connected and controlled by means of an electrical control circuit that is designed in a suitable way.

It should in this connection be mentioned that it is possible to save energy and increase the cooling efficiency by using the container 19 as a heat exchanger for the suction pipe 11. Thus, by enclosing the suction pipe in the container 19, or by bringing these parts together in a heat-transmitting manner, heat is transferred from the warm condensate to the cold vapor in the suction pipe 11. Consequently the cold vapor is heated thereby saving energy at the same time as the warm condensate is cooled which increases the cooling efficiency.

According to the alternative embodiment shown in Fig 2 the hidden volume is instead an integrated part of the condenser 14a. The hidden volume is created by the lower part 19a of the condenser 14a. Thus, when the valve 22a in the pipe 20a is closed the condensate collects at the lower part of the condenser until it reaches the outlet 26a which is connected to the pipe 27a via the valve 29a. Provided that the valve 29a is open the remaining refrigerant in the system is then circulated solely through the upper part of the condenser 14a. This means that liquid is collected and hidden at the lower part of the condenser and that this part can be regarded as inactive seen from a heat transferring point of view. By using this arrangement it is possible to create a condenser having two states a first state with large heat emission and a large filling amount and a second state with less heat emission and filling amount.

CLAIMS

1. Refrigeration system comprising one compressor (10) that via a closed circuit containing a circulating refrigerant is connected to a condenser (14, 14a) and two or more evaporators (21,28) **characterized in** that the circuit comprises a container (19, 19a) or the like communicating with the condenser (14,14a) and having at least a first outlet communicating with at least one evaporator (21) via a first valve (22,22a) or the like, the container (19,19a) being arranged to receive and temporarily store a certain volume of the refrigerant flowing from the condenser, the container (19,19a) also being provided with at least a second outlet (26,26a) communicating with one or several of the additional evaporators (28) to circulate the remaining part of the refrigerant through the at least one of the last mentioned evaporators (28) when said volume has been stored in the container (19,19a), said second outlet (26,26a) being positioned above said first outlet.

2. Refrigeration system according to claim 1 **characterized in** that a second valve (29,29a) or the like is arranged at the second outlet (26,26a).

3. Refrigeration system according to any of claims 1-2 **characterized in** that the circuit is provided with a T-piece (17) constituting a part of the container (19,19a)

4. Refrigeration system according to any of claims 1-3 **characterized in** that the container (19a) is an integrated part of the condenser (14a).

5. Refrigeration system according to claim 4 **characterized in** that the container (19a) is the lower part of the condenser (14a).

6. Refrigeration system according to any of claims 1-5 **characterized in** that the circuit comprises at least one suction pipe (11) arranged between the evaporators (21,28) and the compressor (10) the suction pipe being arranged in heat exchange relationship with the container (19,19a).

7. Method for operating a refrigeration system which is provided with a closed circuit containing a refrigerant that in the vapor state is compressed to a high pressure gas, that the gas is allowed to gradually condense **characterized in** that a part of the condensate is temporarily collected as a non-circulating, hidden volume for later evaporation in a first evaporator and that at least a part of the remaining refrigerant is circulated through a second evaporator when the hidden volume has been filled.